P84

Investigation of the surface of Chlorella microalgae by atomic force microscopy in liquid

A.A. Okhotnikova, V.A. Smirnov

Southern federal university, Institute of Nanotechnologies, Electronics and Equipment Engineering
347928, Taganrog, Russia
ohotnikova@sfedu.ru

Recently, an increase in the demand for fuel leads to a significant problem of the modern world - the limited reserves of coal and oil. In addition, the burning of fossil raw materials leads to the release of carbon dioxide, the accumulation of which leads to a deterioration of the ecological situation in the world. Therefore, the development of alternative methods for obtaining renewable and non-polluting harmful substances from the combustion of fuels is the important task of modern science.

A significant role in solving this problem can play microalgae – photosynthetic organisms that use the energy of sunlight to convert carbon dioxide and water into organic matter. This organic substance can be converted into biodiesel and ethanol. Microalgae are not demanding to live conditions, methods of their cultivation are simple and inexpensive. For the effective cultivation of microalgae, it is necessary to study the geometric parameters and the external influences on their life. New opportunities for studying micro- and nanoscale biological objects are provided by AFM, which allows one to study biological objects without their special sample preparation under natural conditions. The aim of this work is to study the geometric parameters of microalgae Chlorella by AFM and the seasonal change in their morphology.

Water samples taken from the area of the Taganrog Bay of the Azov Sea in the spring were used. Using an optical microscope of scanning probe nanolaboratory (SPN) Ntegra Vita (NT-MDT) the types of microalgae were identified: dinophyte, green, diatom and blue-green. Of greatest interest were green and blue-green microalgae, the starch product of which is starch, and in conditions of nitrogen deficiency - oil. Chlorella prevailed among green algae, which was chosen for study. The optical image of the microalgae data is presented in Figure 1 a.

Then Chlorella microalgae were investigated by atomic force microscopy in liquid on SPN. Silicon cantilever of brand NSG 20 was used. Figure 1 b. the AFM image of Chlorella microalgae obtained by scanning in sea water is presented. During the experiment, it was found that when scanning in air microalgae were also covered with inorganic elements, which distorted the topology of their surface. This problem was solved with the help of AFM method in liquid, which allows to study microalgae in natural conditions, without preliminary sample preparation.

Using the method of AFM in a liquid, the geometrical parameters of microalgae Chlorella were determined. Analysis of the images showed that the length varied from 1.4 to 2.5 μm, its width from 1.1 to 1.45 μm, while in the central part of the microalgae a characteristic deepening was observed from 2 to 41 nm. The results obtained can be used in the development of technological processes for the manufacture of biofuels based on biomass of microalgae.

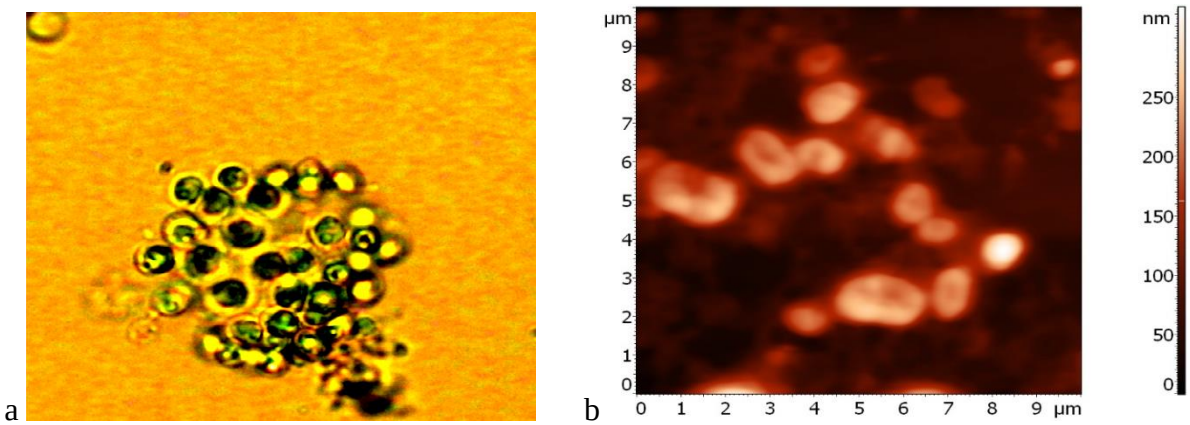

Figure 1. The results of the study of the surface of microalgae Chlorella: (a) optical image of microalgae with magnification ×1100; (b) AFM-image of microalgae, obtained in liquid.